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AutoPore IV 9500

Operator's Manual

SHIMADZU

micromeritics®

AutoPore IV 9500

Operator's Manual

Part No. 950-42801-01

8. TROUBLESHOOTING AND MAINTENANCE

9. ORDERING INFORMATION

APPENDIX D

DATA REDUCTION

DATA REDUCTION

Data for presentation in tabular and plot form is calculated in the following manner:

P_i = head-corrected pressure as stored
V_{ri} = intrusion volume as stored
θ = user-entered contact angle
γ = user-entered surface tension
W_s = user-entered sample weight
W_p = user-entered weight for penetrometer
W_{psm} = user-entered weight for penetrometer + sample + mercury
V_p = user-entered volume for penetrometer
V_c = user-entered volume for capillary (stem)
Y_m = user-entered density for mercury

WASHCON=Washburn constant = $\frac{10^4\ \mu m/cm}{68947.6\ dynes/cm^2\text{–}psia} = 0.145038$

For all calculations requiring interpolation between collected data points, an Akima* method semi-spline is used.

Diameter for the i^{th} point is:

$$D_i = \frac{WASHCON\ \gamma(-4\cos\theta)}{P_i}$$

Radius for the i^{th} point is:

$$R_i = \frac{D_i}{2}$$

Cumulative specific intrusion volume for the i^{th} point is:

$$I_i = \frac{V_i}{W_s}$$

Mean diameter for the i^{th} point is:

$$Dm_i = \frac{D_i + D_{i-1}}{2}$$

* "A New Method of Interpolation and Smooth Curve Fitting Based on Local Procedures," *Journal of the Association of Computing Machinery*, 17(4) 1970, 589-602.

Incremental specific intrusion volume for the i^{th} point is:

$$Ii_i = I_i - I_{i-1}$$

Incremental specific pore area for the i^{th} point is:

$$Ai_i = \frac{4 \times Ii_i}{Dm_i}$$

Cumulative specific pore area for the i^{th} point is:

$$A_i = Ai_i + Ai_{i-1} + \ldots + Ai_1$$

If more than 8 data points are available, differential and log differential specific intrusion volume are calculated as follows.

Differential and log differential data are the 1st derivative of the cumulative specific intrusion volume (all) data as a function of calculated log diameter, normalized by the diameter or log diameter interval. This derivation is comprised of four transformations.

1. Interpolation of cumulative specific intrusion volume vs. log diameter is made to get cumulative specific intrusion volume corresponding to evenly spaced log diameters.

2. The uniform cumulative specific intrusion volume data are then subjected to a 1st derivative calculation, using a 9-point smoothing method. This gives the desired differential data in terms of uniform intervals of collected data.

3. Log differential data are normalized by dividing by the log diameter interval between points. Since the points are evenly log spaced, this interval is the same for all points. Differential data are normalized by dividing by the diameter interval between points. Since the points are evenly log spaced, this interval is larger for larger diameters.

4. Interpolation of the differential or log differential data vs. log diameter is made to get data corresponding to collected data points.

If 8 or fewer data points are available, differential and log differential specific intrusion volume are calculated as follows.

Differential specific intrusion volume by diameter for the i^{th} point is:

$$Id_i = \frac{-Ii_i}{D_i - D_{i-1}}$$

Log differential specific intrusion volume by diameter is:

$$Ild_i = \frac{-Ii_i}{\log D_i - \log D_{i-1}}$$

Differential specific intrusion volume by radius for the i^{th} point is:

$$Ir_i = \frac{-Ii_i}{R_i - R_{i-1}}$$

Log differential specific intrusion volume by radius is:

$$Ilr_i = \frac{-Ii_i}{\log R_i - \log R_{i-1}}$$

Total intrusion volume is:

$$V_{tot} = V_j$$

where the j^{th} point is the first such that:

$$P_{j+1} \le P_j - 10 \quad \text{and} \quad P_{j+1} \le P_j \times 0.995$$

Total specific intrusion volume is:

$$I_{tot} = \frac{V_{tot}}{W_s}$$

Percent of total specific intrusion volume for the i^{th} point is:

$$Ip_i = \frac{100 \times I_i}{I_{tot}}$$

Total specific pore area is:

$$A_{tot} = A_j$$

for point j as defined above.

Median diameter by volume is:

$$D_{mv} = D_k$$

where

$$I_k = \frac{I_{tot}}{2}$$

and P_k is interpolated from I_k and the collected data, and D_k is calculated from P_k.

Median diameter by area is:

$$D_{ma} = D_k$$

where

$$A_k = \frac{A_{tot}}{2}$$

and P_k is interpolated from A_k and the collected data, and D_k is calculated from P_k.

Average diameter is:

$$D_{av} = \frac{4 \times I_{tot}}{A_{tot}}$$

Blank Correction by Formula:

For equilibration time 6 seconds: $X = \log\left(\frac{T}{6}\right)$

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